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Performance and limits of different long-range TLS-sensors for monitoring high mountain geomorphic processes at different spatial scales

M. Avian

Graz University of Technology, Institute of Remote Sensing and Photogrammetry, Graz, Austria (michael.avian@tugraz.at, 0043 316 873 6339)

Terrestrial Laserscanning (TLS) has become an important tool to represent the earth′s surface in small scales in recent years. In high mountain environments with its various processes TLS seems to be an effective method in terms of time and effort, costs and accuracy. The subject of this contribution is to highlight different aspects regarding TLS data accuracy.

Remote sensing techniques always provide data but data quality as well the feasibility for different applications are crucial questions and are sometimes considered insufficiently. There are several questions concerning the applicability of new techniques in remote sensing: Which processes at what scale can be monitored to ensure scientific quality? What are the main factors which influence point cloud quality and consecutively the derived Digital Terrain Models (DTM)? What are the conclusions concerning important terms of quality such as accuracy, repeatability, and reproducibility?

Beginning in 2000, TLS campaigns started with one sensor (Riegl LPM-2k) and were intensified since 2009 with three sensors (additionally Riegl LPM321, Riegl LMS Z620). 200 individual measurements in altogether 52 field campaign days were carried out in five test sites located in the Hohe Tauern Range, Central Austria: glacier tongue Pasterze Glacier (N47°04′, E12°44′), rock fall area Burgstall (N47°05′, E12°44′), glacier Gössnitzkees (N46°58′, E12°45′), rock glacier Hinteres Langtalkar (N46°59′, E12°46′), and solifluction area Fallbichl (N47°04′, E12°50′).. Geomorphic process magnitudes monitored during the TLS campaigns range from 1-2 cm a-1 (e.g. solifluction) to up to 1200 cm a-1 (e.g. vertical glacier surface variations).

To verify measurements and in order to get comparable results, data sets were analysed by: (i) homologue points with direct reference of position (geodetic measurements, GPS), and (ii) Least squares matching (LSM) of point clouds. Results of process oriented measurements as well as considerations concerning the performance of different sensors and measurement set-up are presented.